FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U.S. Department of Energy

Office of Science, Office of Basic Energy Sciences

Basic Research for Solar Energy Utilization

Funding Opportunity Number: **DE-FG02-06ER06-15**

Announcement Type: **Amendment #1**

CFDA Number: **81.049**

A change was made to this FOA Announcement on April 19, 2006. A new requirement was added; see the red text on page 5, PART I – Funding Opportunity Description – Summary, second paragraph.

ISSUE DATE: **March 21, 2006**

PREAPPLICATION DUE DATE: **June 5, 2006 – Required**

APPLICATION DUE DATE: **November 14, 2006, 8:00 pm Eastern Time**

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NOTE: NEW REQUIREMENTS FOR GRANTS.GOV

Where to Submit:
Applications must be submitted through Grants.gov to be considered for award.

Registration Requirements:
There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider, and register with Grants.gov). See www.grants.gov/GetStarted. Use the Grants.gov Organization Registration Checklist at www.grants.gov/assets/OrganizationRegCheck.doc to guide you through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in the CCR registration process. Applicants, who are not registered with CCR and Grants.gov, should allow at least 14 days to complete these requirements. It is suggested that the process be started as soon as possible.

Questions:
Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. Part VII of this announcement explains how to submit other questions to the U.S. Department of Energy.

Application Receipt Notices
After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of four e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to two (2) business days from application submission to receipt of email Number 2. You will know that your application has reached DOE when the AOR receives email Number 4. You will need the Submission Receipt Number (email Number 1) to track a submission. The titles of the four e-mails are:

Number 1 - Grants.gov Submission Receipt Number
Number 2 - Grants.gov Submission Validation Receipt for Application Number
Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number
Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number

After receipt of email Number 4, you can view your application at DOE's e-Center, http://e-center.doe.gov. A User Id and password are required. If you already have a User Id and password you do not need to re-register.

VERY IMPORTANT – Download PureEdge Viewer:
In order to download the application package, you will need to install PureEdge Viewer. This small, free program will allow you to access, complete, and submit applications electronically and securely. For a free version of the software, visit the following web site: www.grants.gov/DownloadViewer.

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PART I – FUNDING OPPORTUNITY DESCRIPTION

SUMMARY: The Office of Basic Energy Sciences (BES) of the Office of Science (SC), U.S. Department of Energy (DOE), in keeping with its mission to assist in strengthening the Nation's scientific research enterprise through the support of fundamental science and the experimental tools to perform basic research, announces its interest in receiving applications for basic research in the area of solar energy utilization. This Notice solicits innovative basic research proposals to establish the scientific basis that underpins the efficient *capture, conversion, and utilization* of solar energy in a cost-effective manner. We seek to support outstanding fundamental research programs that will lead to key discoveries and conceptual breakthroughs to make sunlight as the practicable solution to meet our compelling need for clean, abundant sources of energy.

The application must contain one paragraph addressing how the proposed research will address one or more of the four BES long-term program measures used by the Office of Management and Budget to rate the BES program annually. These measures may be found at http://www.sc.doe.gov/bes/BES_PART_Performance_Measures.pdf.

BACKGROUND INFORMATION

In April 2005, BES sponsored a workshop to identify basic research needs for effective solar energy utilization. Over 200 workshop participants, from academia, national laboratories, government and industry in the US and abroad, critically assessed the state-of-the-art and limitations of current technologies for producing a significant fraction of our primary energy source from sunlight. The workshop report, entitled *Basic Research Needs for Solar Energy Utilization* (http://www.sc.doe.gov/bes/reports/files/SEU_rpt.pdf) detailed a broad array of key scientific challenges and research avenues to address these challenges. This Notice solicits innovative basic research proposals to establish the scientific basis that underpins the efficient *capture, conversion, and utilization* of solar energy in a cost-effective manner. We seek to support outstanding fundamental research programs that will lead to key discoveries and conceptual breakthroughs to make sunlight as the practicable solution to meet our compelling need for clean, abundant sources of energy. As in the workshop report, three broad areas that encompass many of the priority research directions will be the subject of this solicitation. They are:

1. **Solar to Electric Conversion**
2. **Solar Fuels Production**
3. **Solar Thermal Energy Utilization**

The following provides further information under each of these three areas to illustrate the scope of applications solicited under the Notice.

Solar to Electric Conversion

The challenge in converting sunlight to electricity via photovoltaic solar cells is to dramatically reduce the cost/watt of delivered solar electricity by dramatically improving the conversion efficiency. Devices that operate above the existing performance limit will require the discovery of new materials and new pathways for solar to electric conversion. Revolutionary approaches will be needed to minimize thermalization and recombination of photo-generated carriers. These breakthroughs will come from a broad range of research activities in both materials and

topologies, which includes research in single-crystal, polycrystalline, amorphous, and nanostructured inorganic and organic materials; an understanding of the electronic structure of these materials; and their implementation in single and multiple junction solar cells. These cells could potentially take advantage of optical frequency shifting, multiple exciton generation, and hot carrier generation. Basic research is essential for identifying new materials and processes to make efficient solar generated electricity a reality. High priority research directions include:

- ***New concepts in solar electric conversion***. Nano-structured architectures that can efficiently absorb the full spectrum of wavelengths in solar radiation offer the potential to revolutionize the technology used to produce solar electricity. New phenomena, such as multiple exciton generation offer the potential for photovoltaic (PV) cells to go beyond the Shockley-Queisser limit. Structures that are defect tolerant or have the capability to self repair are desired. The use of these materials in multiple junction cells can lead to dramatic advances in PV conversion efficiencies. Advances in nanoscale characterization using electron, neutron, and x-ray scattering and spectroscopy and integration of these probes with studies of photo-induced charge separation and transport will be essential to understand the structure/property relationships in these materials.

- ***Organic and hybrid organic/inorganic conversion systems*.** The current state-of-the-art organic efficiency is considerably less than inorganic based systems. Significant challenges must be overcome to introduce novel cell designs and organic components that create highly efficient and durable solar cells. In order to make advances, the fundamental problems of light absorption and charge separation and transport in organic complexes must be addressed for the organic environment of these solar cells. To increase the operational understanding of these solar cells, new experimental approaches will be needed to correlate the chemical and physical properties of the active components and layers with their performance in operating PV devices. The combination of organic and inorganic materials could also provide new opportunities for the fabrication of high efficiency PV cells. Many, but not all, of these hybrids are materials systems that, along with organic solar cells, contain complex interfaces e.g. organic metal and organic/semiconductor. The interfaces create additional challenges that require advanced molecular design and an understanding of electronic interactions at an organic/inorganic interface.

- ***Photoelectrochemical solar cells***. The photoelectrochemical configuration of photo-excited semiconductor with a redox medium is simple in form and fabrication, but the exploitation of photoelectrochemical cells for electrical power production awaits breakthrough advances in photoelectrode lifetimes and the employment of novel, low-cost solids and electrolytes. Breakthroughs in combinations of sensitizers and redox couples are needed to move into higher solar conversion efficiencies. Enhanced absorption in the infra-red spectrum by sensitizing dyes and quantum dots will be necessary. It is also necessary to understand the relation between the efficacy of the regenerating agent and the configuration of the mesoporous semiconductor network. Novel mesoscopic electrode designs, derived from nanostructured and nanoporous solids, are also needed. New surface chemistries and unique designs for assembling these mesoporous solids at low temperatures are sought where the electrode retains a high

conductivity. Highly ordered interdigitated passageways for charge transport may be possible as are self-assembled forms of these solid networks.

- ***Novel nanoscale and self-assembled materials***. New techniques, tools, and design principles are needed to allow optimized, photovoltaic materials and photonic structures to be fabricated over large-area substrates. Studies of nucleation and growth of novel materials can involve kinetically or thermodynamically driven self-assembly of tailored building blocks, or they may rely upon construction of the active layers and devices using carefully controlled vapor or solution-based deposition methods.

- ***Theory, modeling, and simulation***. Solar energy systems exploit complex and multi-scale phenomena associated with molecules, materials, and their interplay with the system architecture. New theoretical, modeling, and computational tools which span many decades in space, time and structure are required to guide and interpret experiment and assist in the design of molecules, materials and systems. Improved theory and methods for electron transfer and charge separation, excited-states, their properties and their potential energy surfaces need to be developed and validated. Enhanced capabilities for excited states must enable accurately predicted band-gaps, lifetimes and band offsets generally, but especially in materials that are realistic candidates for solar energy systems.

Solar Fuels Production

Because of the day/night variation of the solar resource, the practical use of solar energy faces two overarching technological challenges: economically converting sunlight into useful energy, and storing and dispatching that converted energy to end users in an economical, convenient form. There must be a means to cost-effectively convert this energy into forms useful for transportation, residential and industrial applications. The ability to use sunlight to produce CH_4 or H_2 from abundant, non-toxic resources such as CO_2 and water would revolutionize the economical, environmentally sound production of fuels. There are two key challenges in cost-effective formation of solar fuels. One is to replicate the essential components of the photosynthetic machinery to store chemical energy outside of a natural organism or plant. The other is to construct entirely man-made chemical components that, as an assembly, absorb sunlight and convert the energy into chemical fuels such as CH_4 and H_2. Examples of topical areas in which innovative research is needed include:

- ***Natural photosynthetic systems***. The resolution of fundamental structural design principles in natural photosynthesis provides a means to accelerate the discovery of synthetic architectures that embody mechanistic principles used in biology. Design principles must be established for known and new natural photosynthetic systems in order to maximize the efficiencies of solar energy capture, conversion, and storage and enable the assembly of efficient biomimetic systems. Meeting these challenges will involve the understanding and control of the weak intermolecular forces governing molecular assembly in natural photosynthesis as well as the determination of the rules that underlie the biological mechanisms for repair and photoprotection.

- ***Bioinspired molecular assemblies.*** The challenge in bioinspired systems is to use the principles and architectures found in natural photosynthetic systems to prepare molecular

assemblies that integrate light absorption, charge separation, and transport in an effective way. This innovation will involve the construction of tailored environments, composed of polymers, membranes, and gels, for organization of the antenna and donor-acceptor reaction center components (smart matrices). Bioinspired molecular systems with a pathway for fuels production must couple these single photon events to multiple redox equivalents in order to accumulate photon-initiated redox equivalents at particular molecular site. A resolution of the structural and electronic dynamics will be required over the full time scale of energy capture and conversion, which will involve the use of ultrafast spectroscopies and atomic level microscopies as well as new, emerging methods for dynamic molecular structure determination. Advanced tools and techniques that are available (or being conceived) at DOE-BES supported synchrotron and neutron facilities and Nanoscale Science Research Centers may be useful in this regard.

- ***Defect tolerant and self-repairing conversion.*** To ensure that complex biomimetic systems maintain their efficiency over long lifetimes, it is necessary to understand the repair and photoprotection mechanisms in photosynthesis and to be able to translate these mechanisms into a structure and an operating mechanism for biomimetic photosystems. Within an artificial photosynthetic system, the structural features of the protein matrix provide for redundancy as well as enhanced stability of photoreactants. A challenging and general approach to self-repair will require the design of smart molecules that seek out damage sites within a modular artificial photosynthetic system, recognize the damage site, and execute a structural repair. This approach requires building into molecules the self-autonomous features that are common in biology, but have not yet been developed for non-living systems. These investigations may also impact the development of defect-tolerant organic and inorganic PV materials.

- ***Solar hydrogen production.*** Photoelectrochemical water splitting for hydrogen production represents an advanced alternative to combining PV cells with an electrolysis system. Discovery of photoelectrodes that have appropriate light absorption characteristics, are stable in aqueous solutions, and possess catalytic activity for multi-electron reactions is essential to produce hydrogen. Combinatorial or high-throughput methods and advanced computational methods will be useful in this regard. Emphasis must also be placed on the configuration of discovered electrodes for optimal light absorption by use of visible-absorbing dyes, carrier collection and electrocatalysis by band gap engineering, and optimizing interfaces.

- ***Photocatalytic fuels formation.*** Practical solar fuel formation requires construction of catalytic systems for the formation of energy rich fuels, such as the reduction of CO_2 to CH_4. The performance of the current generation of catalysts is far from that required for a solar fuels production system of the desired breakthrough efficiency goals, so that development of a new generation of fuel-forming catalysts is necessary. All methods for producing solar fuels must involve coupling of photo-driven single electron steps with fuel forming multi-electron transfer processes. A greater understanding is required, therefore, of the mechanisms of complex coupled reactions, excited-state bond making and breaking processes, and proton-coupled electron transfer reactions. These events can also occur in catalytic reactions at interfaces and surfaces. Experimental efforts must be coupled with theoretical investigations of the rates and mechanisms of multi-

electron/multi-atom transfer reactions. Discovery of highly efficient, non-noble metal catalysts is also highly desirable.

- ***Theory, modeling, and simulation.*** Significant theoretical challenges are raised by the complex nature of supramolecular assemblies with their varied host architectures and their relation to light-initiated electronic and nuclear dynamics in the photosystem. New, multi-scale theoretical/computational methods are critically needed to account for the complexities of excited-state energetics applied across multiple spatial length scales relevant to supramolecular structures within complex host architectures and on the range of time scales encompassing solar-energy capture, conversion, and storage. New theoretical methods are essential for establishing predictive methods to accelerate the design of efficient systems for solar fuels production.

Solar Thermal Energy Utilization

High efficiency thermoelectric and thermophotovoltaic converters coupled to solar concentrators have the potential to generate electricity with significant increase in conversion efficiency. Currently, terrestrial thermoelectric and thermophotovoltaic systems are based on combustion heat, with the novel area of solar-based thermoelectric and thermophotovoltaic being little explored. Fundamental research is needed in the following areas:

- ***Thermoelectrics.*** Thermoelectric materials that can independently reduce phonon transport without deteriorating electronic transport offer great promise in significant enhancement in thermoelectric conversion efficiency. Bulk materials that exhibit nanoscale sub-structure and nanocomposites may offer a revolutionary approach to achieving high performance thermoelectricity. A comprehensive understanding of the role of interfaces in low-dimensional systems is needed to provide theoretical guidance on designing new generations of thermoelectric materials with significant ZT enhancement through quantum-confinement effects. Novel theory, modeling and simulation efforts are especially sought to provide the theoretical framework to assist the design of advanced thermoelectric materials that decouple electron transport from phonon transport.

- ***Thermophotovoltaics.*** One of the major challenges of spectral control for thermophotovoltaics (TPV) system is given by the high operating temperatures. Metallic and dielectric materials with low diffusion rates and evaporation rates are needed. New device concepts should be explored, such as microgap TPV. Novel materials and approaches in photonic crystals, plasmonics, phonon-polariton interactions, and coherent thermal emission are sought to exploit the spectral design and control required in TPV systems.

- ***Thermal storage.*** Thermal storage materials require high latent heat density and sufficiently high thermal conductivity for enhanced thermal energy charge and discharge processes. Present thermal storage materials are limited by the lack of reversibility of structural transformations in extended solids. The unique characteristics of solid-solid structural transformations in nanoscale materials offer great promise in overcoming the barriers. Basic research is needed to develop a comprehensive understanding governing the hysteresis and kinetics of the structural transitions in nanoscale materials with the

goal of designing thermal storage materials and transitions that will perform under the appropriate conditions for solar thermal applications.

PART II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT.

DOE anticipates awarding grants under this program announcement.

B. ESTIMATED FUNDING.

It is anticipated that up to $20 million annually will be available for multiple awards for this notice. Initial awards will be in Fiscal Year 2007, and applications may request project support for up to three years. All awards are contingent on the availability of funds and programmatic needs.

C. MAXIMUM AND MINIMUM AWARD SIZE.

Ceiling (i.e., the maximum amount for an individual award made under this announcement): None

Floor (i.e., the minimum amount for an individual award made under this announcement): None

D. EXPECTED NUMBER OF AWARDS.

The number of awards will be contingent on satisfactory peer review, the availability of appropriated funds and the size of the awards.

E. ANTICIPATED AWARD SIZE.

N/A

F. PERIOD OF PERFORMANCE.

N/A

G. TYPE OF APPLICATION.

N/A

PART III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS.

All types of applicants are eligible to apply, except other Federal agencies, Federally Funded Research and Development Center (FFRDC) Contractors, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.

Researchers from Federally Funded Research and Development Centers (FFRDCs) or DOE National Laboratories should respond to Program Announcement LAB 06-15, available at the following web address: http://www.science.doe.gov/grants/LAB06_15.html.

B. COST SHARING

Cost sharing is not required.

C. OTHER ELIGIBILITY REQUIREMENTS.

N/A

PART IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE.

Application forms and instructions are available at Grants.gov. To access these materials, go to http://www.grants.gov, select "Apply for Grants", and then select "Download Application Package". Enter the CFDA and/or the funding opportunity number located on the cover of this announcement and then follow the prompts to download the application package. NOTE: You will not be able to download the Application Package unless you have installed PureEdge Viewer (See: http://www.grants.gov/DownloadViewer).

B. LETTER OF INTENT AND PREAPPLICATION.

1. Letter-of-Intent.

Letters-of-Intent are not required.

2. Preapplication.

Potential applicants are **REQUIRED** to submit a brief preapplication. Preapplications referencing Program Notice DE-FG02-06ER06-15, must be received by DOE by 4:30 p.m., Eastern Time, June 5, 2006. Preapplications will be reviewed for conformance with the guidelines presented in this Notice and suitability in the technical areas specified in this Notice. A response to the preapplications encouraging or discouraging formal applications will be communicated to the applicants by August 11, 2006.

Preapplications referencing Program Notice DE-FG02-06ER06-15 should be sent as an Excel and PDF file attachments via e-mail to: solarenergy@science.doe.gov with "DE-FG02-06ER06-15" as the subject. No FAX or mail submission of preapplications will be accepted. **Do not submit preapplications via grants.gov.**

Only those preapplicants that receive notification from DOE encouraging a formal application may submit a formal application. **No other formal applications will be considered.**

C. CONTENT AND FORM OF APPLICATION – SF 424 (R&R)

You must complete the mandatory forms and any applicable optional forms (e.g., SF-LLL-Disclosure of Lobbying Activities) in accordance with the instructions on the forms and the additional instructions below**. Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this announcement.**

1. SF 424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. To activate the instructions, turn on the "Help Mode" (Icon with the pointer and question mark at the top of the form). The list of certifications and assurances referenced in Field 18 can be found on the Applicant and Recipient Page at http://grants.pr.doe.gov.

2. RESEARCH AND RELATED Other Project Information.

Complete questions 1 through 5 and attach files. The files must comply with the following instructions:

Project Summary/Abstract (Field 6 on the Form)

The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to publication. It should be a single page that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public. The project summary must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click "Add Attachment."

Project Narrative (Field 7 on the form)

The project narrative must not exceed 20 pages, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right). EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application, because the information contained in these sites will not be reviewed. To attach a Project Narrative, click "Add Attachment."

The Research & Related Other Project Information form of the Grants.gov template should be completed in the following manner. **Project Narrative is Field 7 on the form.** The first page of your narrative must include the following information:

Applicant/Institution:
Street Address/City/State/Zip:
Principal Investigator:
Address:
Telephone Number:
Email:
Science Element:
DOE/Office of Science Program Office:
DOE/Office of Science Program Office Technical Contact:
DOE Grant Number (if Renewal or Supplemental Application):
Is this a Collaboration? If yes, please list ALL Collaborating Institutions/PIs and indicate which ones will also be submitting applications. Also indicate the PI who will be the point of contact and coordinator for the combined research activity.

Project Narrative, 20 pages or less, Project Narrative must not exceed 20 pages, including tables and figures, but exclusive of attachments. The application must contain an abstract or project summary, short vitae, and letters of intent from collaborators if appropriate, a listing of all current and pending federal support.

Biographical Sketches
Current and Pending Support
Letters of Intent
Facilities and Resources
Literature Cited

Applications not meeting these requirements will be deemed ineligible during the initial screening process.

The project narrative must include:

- Project Objectives.
  This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.

- Evaluation Phase
  This section must include a plan and metrics to be used to assess the success of the project.

- Project Performance Site
  Indicate the primary site where the work will be performed. If a portion of the work will be performed at any other sites, identify those sites, also.

- Biographical Sketch Appendix
  Provide a biographical sketch for the project director/principal investigator (PD/PI) and each senior/key person listed in Section A on the R&R Budget form. **Provide the biographical sketch information as an appendix to your project narrative. Do not attach a separate file.** The biographical sketch appendix will not count in the project narrative page limitation. The biographical information for each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include:

  Education and Training. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

  Research and Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

  Publications. Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website

address if available electronically.

Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than 5 professional and scholarly activities related to the effort proposed.

- *Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers.* Provide the following information in this section:

  Collaborators and Co-editors: List in alphabetical order all persons, including their current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this application. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this application. If there are no collaborators or co-editors to report, state "None."

  Graduate and Postdoctoral Advisors and Advisees: List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s) during the last 5 years. Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates during the past 5 years.

- Current and Pending Support.
  Provide a list of all current and pending support (both Federal and non-Federal) for the Project Director/Principal Investigator(s) (PD/PI) and senior/key persons, including subawardees, for ongoing projects and pending applications. For each organization providing support, show the total award amount for the entire award period (including indirect costs) and the number of person-months per year to be devoted to the project by the senior/key person. Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review.

Bibliography & References Cited (Field 8 on the form)

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. **In order to reduce the number of files attached to your application, please provide the Bibliography and References Cited information as an appendix to your project narrative. Do not attach a file in field 8.** This appendix

will not count in the project narrative page limitation.

Facilities & Other Resources (Field 9 on the form)

This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. **In order to reduce the number of files attached to your application, please provide the Facility and Other Resource information as an appendix to your project narrative. Do not attach a file in field 9.** This appendix will not count in the project narrative page limitation.

Equipment (Field 10 on the form)

List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities. **In order to reduce the number of files attached to your application, please provide the Equipment information as an appendix to your project narrative. Do not attach a file in field 10.** This appendix will not count in the project narrative page limitation.

Other Attachment (Field 11 on the form)

If you need to elaborate on your responses to questions 1-5 on the "Other Project Information" document, **provide the information as an appendix to your project narrative. Do not attach a file in field 11.**

3. RESEARCH AND RELATED BUDGET.

Complete the Research and Related Budget form in accordance with the instructions on the form (Activate Help Mode to see instructions) and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (See PART IV, G).

Budget Justification (Field K on the form).
Provide the required supporting information for the following costs (See R&R Budget instructions): equipment; domestic and foreign travel; participant/trainees; material and supplies; publication; consultant services; ADP/computer services; subaward/consortium/contractual; equipment or facility rental/user fees; alterations and renovations; and indirect cost type. Provide any other information you wish to submit to justify your budget request. If cost sharing is required, provide an

explanation of the source, nature, amount and availability of any proposed cost sharing. Attach a single budget justification file for the entire project period in Field K. The file automatically carries over to each budget year.

4. **R&R SUBAWARD BUDGET ATTACHMENT(S) FORM.**
Budgets for Subawardees, other than DOE FFRDC Contractors. You must provide a separate cumulative R&R budget for each subawardee that is expected to perform work estimated to be more than $100,000 or 50 percent of the total work effort (whichever is less). If you are selected for award, you must submit a multi-year budget for each of these subawardee (See Section IV.D for submission of Subawardees' multi-year budgets). Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET ATTACHMENT(S) FORM and e-mail it to each subawardee that is required to submit a separate budget. Note: Subwardees must have installed PureEdge Viewer before they can complete the form. After the Subawardee has e-mailed its completed budget back to you, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee's name (plus .xfd) as the file name (e.g., ucla.xfd or energyres.xfd).

5. **SF-LLL Disclosure of Lobbying Activities**
If applicable, complete SF- LLL. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS.

The Department anticipates that no additional submissions will be required. However, it reserves the right to request additional or clarifying information for any reason deemed necessary.

E. SUBMISSION DATES AND TIMES.

1. Preapplication Due Date.

Potential applicants are **REQUIRED** to submit a brief preapplication. Preapplications referencing Program Notice DE-FG02-06ER06-15, must be received by DOE by 4:30 p.m., Eastern Time, June 5, 2006. Preapplications will be reviewed for conformance with the guidelines presented in this Notice and suitability in the technical areas specified in this Notice. A response to the preapplications encouraging or discouraging formal applications will be communicated to the applicants by August 11, 2006.

Only those preapplicants that receive notification from DOE encouraging a formal application may submit a formal application. **No other formal applications will be considered.**

Preapplication Review and Criteria

The preapplication should consist of a description of the research proposed to be undertaken by the applicant and a clear explanation of its relevance and impact on improved utilization of solar energy. The preapplication must be submitted electronically to solarenergy@science.doe.gov as two files:

(1) A cover page in Excel format downloadable from: http://www.science.doe.gov/bes/Solar_preapp_cover.xls. The information to be entered on the cover page includes: Program Announcement Number; Lead Principal Investigator name, address, email address, telephone number, and fax number; project title; name and institution of all co-Principal Investigators and/or senior collaborators (excluding postdocs and graduate students); selection of one primary and multiple secondary submission categories (see below); budget request for each project year; and total budget request for the project. Please do not alter the overall format of the cover-page Excel file, i.e., do not move or merge cells, as this will significantly slow the processing of the preapplication.

(2) A PDF file containing a narrative section not to exceed 3 pages (including text and figures) describing the research objectives, approaches to be taken, the institutional setting, and a description of any research partnership if appropriate; and brief, one-page, vitae for each Principal Investigator.

As noted above, the preapplication must identify primary and secondary submission categories for the purposes of appropriate peer review. Applicants should identify their preapplication by indicating the number and title of the primary and secondary submission categories on the cover page. The submission categories are:

Solar Research Submission Categories:

1. **New concepts in solar electric conversion**
2. **Organic and hybrid organic/inorganic conversion systems**
3. **Photoelectrochemical solar cells**
4. **Natural photosynthetic systems**
5. **Bioinspired molecular assemblies**
6. **Defect tolerant and self-repairing conversion**
7. **Solar hydrogen production**
8. **Photocatalytic fuels formation**
9. **Solar thermal energy utilization**
10. **Novel nanoscale and self-assembled materials**
11. **Theory, modeling, and simulation**

Each preapplication must indicate a *single* primary research category from among this list; the applicant(s) may also check any number of secondary research areas.

2. **Application Due Date**.

Only those preapplicants that receive notification from DOE encouraging a formal application may submit a formal application. **No other formal applications will be considered.** Formal applications submitted in response to this notice must be received by 8:00 p.m., Eastern Time

November 14, 2006, in order to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2007. You are encouraged to transmit your application well before the deadline. APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEW OR CONSIDERED FOR AWARD.

F. GOVERNMENTAL REVIEW .

This program is subject to Executive Order 12372 (Intergovernmental Review of Federal Programs) and the regulations at 10 CFR Part 1005.

One of the objectives of the Executive order is to foster an intergovernmental partnership and a strengthened federalism. The Executive order relies on processes developed by State and local governments for coordination and review of proposed Federal financial assistance.

Applicants should contact the appropriate State Single Point of Contact (SPOC) to find out about, and to comply with, the State's process under Executive Order 12372. The names and addresses of the SPOCs are listed on the Web site of the Office of Management and Budget at http://www.whitehouse.gov/omb/grants/spoc.html.

G. FUNDING RESTRICTIONS.

Cost Principles**.** Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600.

Pre-award Costs**.** Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. Where to Submit.

APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV TO BE CONSIDERED FOR AWARD. Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@grants.gov.

2. Registration Process.

You must COMPLETE the one-time registration process (all steps) before you can submit your first application through Grants.gov (See www.grants.gov/GetStarted). **We recommend that you start this process at least two weeks before the application due date**. It may take 14 days or more to complete the entire process. Use the Grants.gov Organizational Registration Checklists at http://www.grants.gov/assets/OrganizationRegCheck.doc to guide you through the process. IMPORTANT: During the CCR registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called "Marketing Partner identification Number" (MPIN).

Part V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria.

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR 605.10(b).

2. Merit Review Criteria.

The review process will consist of a merit review of the application, which may include a site visit, followed by a programmatic and administrative review of applications being considered for award.

Applications will be subjected to formal merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance codified at 10 CFR 605.10(d):

1. Scientific and/or Technical Merit of the Project;
2. Appropriateness of the Proposed Method or Approach;
3. Competency of Applicant's Personnel and Adequacy of Proposed Resources;
4. Reasonableness and Appropriateness of the Proposed Budget; and
5. Basic research that is relevant to improved utilization of solar energy.

As part of the evaluation, program policy factors also become a selection priority. Note, external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Federal and non-federal reviewers will be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

B. REVIEW AND SELECTION PROCESS.

1. Merit Review.

Applications will be subjected to formal merit review (peer review) and will be evaluated against the evaluation criteria codified at 10 CFR 605.10(d) listed above, as well as the additional criteria listed above.

2. Selection.

The Selection Official will consider the merit review recommendation, program policy factors, and the amount of funds available.

3. Discussions and Award.

The Government may enter into discussions with a selected applicant for any reason deemed necessary, including but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR part 600 and 605; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES.

DOE is striving to make awards within eight months. The time interval begins on the date applications are due or the date the application is received, if there is no specified due date/deadline.

Part VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES.

1. Notice of Selection.

DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Part IV.G with respect to the allowability of pre-award costs.)

Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award.

A Notice of Financial Assistance Award issued by the contracting officer is the authorizing award document. It normally includes, either as an attachment or by reference: 1. Special Terms and Conditions; 2. Applicable program regulations, if any; 3. Application as approved by DOE; 4. DOE assistance regulations at 10 CFR Part 600, or, for Federal Demonstration Partnership (FDP) institutions, the FDP terms and conditions; 5. National Policy Assurances to Be Incorporated As Award Terms; 6. Budget Summary; and 7. Federal Assistance Reporting Checklist, which identifies the reporting requirements.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS.

1. Administrative Requirements.

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR Part 600 and 10 CFR Part 605 (See: http://ecfr.gpoaccess.gov), except for grants made to Federal Demonstration Partnership (FDP) institutions. The FDP terms and conditions and DOE FDP agency specific terms and conditions are located on the National Science Foundation web site at http://www.nsf.gov/awards/managing/fed_dem_part.jsp.

2. Special Terms and Conditions and National Policy Requirements.

Special Terms and Conditions and National Policy Requirements.
The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at http://grants.pr.doe.gov. The National Policy Assurances To Be Incorporated As Award Terms are located at http://grants.pr.doe.gov.

Intellectual Property Provisions.
The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://www.gc.doe.gov/techtrans/sipp_matrix.html.

C. REPORTING.

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F4600.2, attached to the award agreement.

Reporting Requirements

PART VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions regarding the content of the announcement must be submitted through the "Submit Question" feature of the DOE Industry Interactive Procurement System (IIPS) at http://e-center.doe.gov. Locate the program announcement on IIPS and then click on the "Submit Question" button. Enter required information. You will receive an electronic notification that your question has been answered. DOE will try to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website.

Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. DOE cannot answer these questions.

Questions regarding the program (**technical**) requirements should be directed to:

Agency Contacts:

For specific information on DOE interests, contact:

Dr. Eric A. Rohlfing
Chemical Sciences, Geosciences and Biosciences Division
SC-22.1/Germantown Building
Office of Basic Energy Sciences
Office of Science
U.S. Department of Energy
1000 Independence Ave., SW
Washington, D.C. 20585-1290
Telephone: (301) 903-8165
E-mail: eric.rohlfing@science.doe.gov
Fax: (301) 903- 0271

Dr. Aravinda Kini
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Telephone: (301) 903-3565
E-mail: Aravinda.kini@science.doe.gov
Fax: (301) 903-9513

PART VIII - OTHER INFORMATION

A. MODIFICATIONS.

Notices of any modifications to this announcement will be posted on Grants.gov and the DOE Industry Interactive Procurement System (IIPS). You can receive an email when a modification or an announcement message is posted by joining the mailing list for this announcement through the link in IIPS. When you download the application at Grants.gov, you can also register to receive notifications of changes through Grants.gov.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE.

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS.

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. PROPRIETARY APPLICATION INFORMATION.

Patentable ideas, trade secrets, proprietary or confidentional commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the application which are to be restricted:

"The data contained in pages _____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL.

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application.

Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM.

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph G below.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to insure the commercialization of technology developed under a DOE agreement.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER.

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

H. N/A

I. N/A